PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in or relating to Crankshafts.

I, HARRY RALPH RICARDO, British Subject, of 21, Suffolk Street, Pall Mall, London, S.W. 1, do hereby declare the nature of this invention to be as follows:—

This invention relates to crankshafts for fluid pressure engines, pumps or compressors, and has for its object to provide improved apparatus of a simple character which will tend to damp out torsional oscillations in the crankshaft.

To this end according to the present invention there is associated with one or more of the crank webs of a crankshaft an annular inertia mass member mounted so as to be capable of rotational movement on the web about the crankshaft axis and in frictional contact with the crank web, this mass member acting as a torsional oscillation damper for the crankshaft.

Conveniently the crank web or each crank web with which such an inertia mass member is associated is formed symmetrical about the crankshaft axis and of circular cross-section in a plane at right angles to such axis, the annular inertia mass member being so mounted on the crank web as to be capable of rotating therewith or relatively thereto about the axis of the crankshaft and web.

When such an arrangement is applied to a crankshaft through which lubricating oil is circulated an annular groove may be provided between the crank web and the inertia member which surrounds it, through which groove the oil is caused to flow so that the apparatus acts as a centrifugal separator for the oil tending to cause impurities therein to be thrown outwards against the inner circumferential surface of the inertia member.

In any case, where a crank web of circular form is employed with an annular inertia member surrounding it as described above, the frictional contact between the web and the inertia member is conveniently effected by one or more spring rings interposed between these members, while, when such apparatus is provided with an annular oil groove so as to act as a centrifugal oil separator as indicated above, spring rings may be disposed on each side of this groove so as to act as sealing rings to prevent escape of oil therefrom in addition to effecting the frictional contact between the crank web and the inertia member.

With such an arrangement the pressure of the oil may be relied upon alone or in conjunction with spring pressure derived either from the rings themselves or from one or more separate springs, to force the rings against the sides of their grooves and the inner circumferential surface of the inertia member and thus provide the necessary frictional contact between the parts. Further, means such as pegs may be provided to prevent rotation of the rings relatively to the crank web.

It is to be understood that other means may be provided to effect the frictional contact between the crank web and the inertia mass or to prevent leakage of oil from the oil groove either instead of or in addition to the spring rings referred to above.

The invention may be carried into practice in various ways but the following is a description by way of example of one construction according to this invention.

The crankshaft is of the multi-throw type and has one or more "flying" crank webs, that is webs connecting two adjacent crank pins which have no crankshaft bearing between them. Each flying web is of circular cross-section in a plane at right angles to the axis of rotation of the crankshaft and is surrounded by an annular inertia member of appreciable mass so mounted thereon as to be free to rotate therewith or relatively thereto about the crankshaft axis. The crank web is formed with a circumferential groove with which communicate at substantially diametrically opposite points passages in the crank pins through which lubricating oil is adapted to flow. The inertia member is also preferably provided with a shallow internal circumferential groove which together with the circumferential groove in the web forms an annular chamber through which oil can flow from the oil passage in one crank pin to that in the other. Arranged on each side of this annular chamber and so as each to lie

[*Price* 1/-]

partly in an external circumferential groove on the crank web and partly in an internal circumferential groove in the inertia member are two spring rings similar in form to piston rings. These rings not only effect frictional contact between the crank web and the inertia member and serve as sealing rings to prevent the escape of oil through the spaces on each side of the annular oil chamber between the web and the inertia member, but also locate the inertia member axially on the crank web.

The groove in the inertia member in which the outer circumferential part of each ring lies is preferably provided with a series of radial holes extending therefrom to the outer surface of the inertia member so as to permit contraction of the ring when it is desired to remove the inertia member.

It will be seen that the apparatus above described will not only act as a torsional oscillation damper for the crankshaft by reason of the frictional contact between the crank web or webs and the inertia member or members, but further that it will act as a centrifugal separator for the oil flowing through the crankshaft, any solid particles therein tending to be thrown outwards into the groove in the inner circumferential surface of the inertia member.

It is to be understood that, although the invention has been described with particular reference to its application to a "flying" crank web, it may be applied to other crank webs and to crankshafts having different numbers of cranks. Further, the invention may be applied to one or more crank webs of a multi-throw crankshaft and the form of the crank webs and the inertia member and the manner in which frictional contact between them is effected may be varied without departing from this invention.

Dated this 2nd day of April, 1929.
KILBURN & STRODE,
Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in or relating to Crankshafts.

I, HARRY RALPH RICARDO, British Subject, of 21, Suffolk Street, Pall Mall, London, S.W. 1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to crankshafts for fluid pressure engines, pumps or compressors of the kind wherein a torsional oscillation damper is provided comprising an annular inertia member surrounding and frictionally connected to a crank web which is circular in cross-section in a plane at right angles to the crankshaft axis and is coaxial with respect to such axis.

The object of the invention is to provide an improved crankshaft assembly of the above kind wherein lubricating oil is circulated through passages in the crankshaft.

According to the present invention the annular inertia member and the crank web which it surrounds are so formed as to provide an annular groove between them through which the lubricating oil flows, the apparatus acting as a centrifugal separator for the oil tending to cause impurities therein to be thrown outwards against the inner circumferential surface of the inertia member.

The means for effecting frictional contact between the inertia member and the crank web may vary but preferably comprise one or more spring rings disposed on each side of the annular groove through which the oil flows and serving not only as sealing rings to prevent leakage of oil from such groove but also to establish the whole or a part of the frictional connection between the crank web and inertia member.

With such an arrangement the pressure of the oil may be relied upon alone or in conjunction with the spring pressure derived either from the rings themselves or from one or more separate springs to force the rings against the sides of the annular groove and the inner circumferential surface of the inertia member and thus provide the necessary frictional connection between these parts. Further, means such as pegs may be provided to prevent rotation of the rings relatively to the crank web.

It is to be understood that other means may be provided to effect the frictional connection between the crank web and inertia member or to prevent leakage of oil from the oil groove either instead of or in addition to the spring rings referred to above.

The invention may be carried into practice in various ways but one construction according to this invention is illustrated by way of example in side elevation partly in section in the accompanying

drawing.

In the construction illustrated, the crankshaft to which the invention is applied is of the multi-throw type, only two of the cranks being shown, however, for the sake of convenience. The portion of the crankshaft illustrated comprises a shaft length A adapted to be supported in a main bearing (not shown) and carrying a crank web B, between which and a flying crank web C extends a crank pin D adapted to be engaged by the bearing D^1 for the lower end of a connecting rod D^2. Extending between the flying web C and a further crank web E is a second crank pin F to which is adapted to be connected by a bearing F^1 a connecting rod F^2. The crank web E is connected to a second shaft length G adapted to be supported in a main bearing in the crank case.

The flying web C which is symmetrical about the crankshaft axis and of circular cross-section in a plane at right angles to such axis is surrounded by an annular inertia member H of appreciable mass so mounted on the web as to be capable of rotating therewith or relatively thereto about the axis of rotation of the crankshaft.

The crank web C is provided with a circumferential groove C^1 and an internal circumferential groove H^1 is also preferably provided in the inner wall of the inertia mass member H, these grooves together forming an annular passage J through which oil is adapted to flow from an oil passage D^3 in the crank pin D to a substantially diametrically opposite oil passage F^3 in the crank pin F, these oil passages D^3, F^3, and the annular chamber J constituting part of a complete system of passages in the crankshaft through which oil is caused to flow so as to deliver oil to the main and connecting rod bearings. Thus the shaft length A is provided with a passage A^1 to which oil is supplied through a slip ring K from a pipe K^1 and from which it flows through a further passage B^1 in the crank web B to the passage D^3 in the crank pin D. From this passage it flows as described above through the annular chamber J into the passage F^3 in the other crank pin F and thence through a further passage E^1 in the crank web E to a passage G^1 in the shaft length G, radial passages A^3, D^4, F^4 and G^2 being provided in the shaft lengths A and G and the crank pins D and F for delivering oil to the bearings surrounding them. The lubricating system is preferably of the type wherein oil is circulated under pressure continuously through the crankshaft.

Arranged on each side of the annular chamber J and so as each to lie partly in an external circumferential groove in the crank web C and partly in an internal circumferential groove in the inertia member H is a spring ring L similar in form to a piston ring. These rings not only effect frictional contact between the crank web C and the inertia member H and serve as sealing rings to prevent the escape of oil through the spaces on each side of the annular oil chamber J, but also locate the inertia member H axially on the crank web.

The groove in the inertia member H in which the outer circumferential part of each ring L lies is preferably provided with a series of radial holes M extending therefrom to the outer surface of the inertia member, as shown, so as to permit the insertion of pins to effect the contraction of the ring L when it is desired to remove the inertia member from the crank web.

In the construction illustrated the oil pressure within the chamber J will tend to force the rings against the sides of their grooves in the web C and inertia member H so as to increase the friction between each ring and these members. In some cases, however, one or more springs may be arranged so as to press the rings into contact with the sides of their grooves, such an arrangement being applicable either to an arrangement such as that described above wherein the oil pressure exerts a side thrust on the rings or to similar arrangements according to this invention wherein the oil circulated through the crank web does not act on the spring rings.

It will be seen that the apparatus above described will not only act as a torsional oscillation damper for the crankshaft by reason of the frictional contact between the crank web and the inertia member, but further that it will act as a centrifugal separator for the oil flowing through the crankshaft, any solid particles therein tending to be thrust outwards into the groove H^1 in the inner circumferential surface of the inertia member H.

It is to be understood that, although the invention has been described with particular reference to its application to a "flying" crank web it may be applied to other crank webs and to crankshafts having different numbers of cranks. Further, the invention may be applied to one or more crank webs of a multi-throw crankshaft and the form of the crank webs and the inertia member and the manner in which frictional contact between them is effected may be varied without departing from this invention.

Having now particularly described and

ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a crankshaft provided with passages through which oil is circulated and having a crank web of circular cross-section in a plane at right angles to the crankshaft axis and coaxial with respect to such axis, an annular inertia member being mounted on the web so as to be capable of rotating therewith or relatively thereto about the crankshaft axis, with means connecting the inertia member frictionally to the crank web, the combination of an inertia member and crank web so formed as to provide an annular groove between them through which the lubricating oil flows the apparatus acting as a centrifugal separator for the oil tending to cause impurities therein to be thrown outwards against the inner circumferential surface of the inertia member.

2. In a crankshaft the combination with a crank web and inertia member as claimed in Claim 1, of one or more spring rings disposed on each side of the annular groove through which the oil flows and serving both as sealing rings to prevent leakage of oil from such groove and also to establish the whole or a part of the frictional connection between the crank web and inertia member.

3. The complete crankshaft-web with an inertia member surrounding and frictionally connected to the web and serving as an oil separator substantially as described and illustrated in the accompanying drawings.

Dated this 11th day of December, 1929.
KILBURN & STRODE,
Agents for the Applicant.

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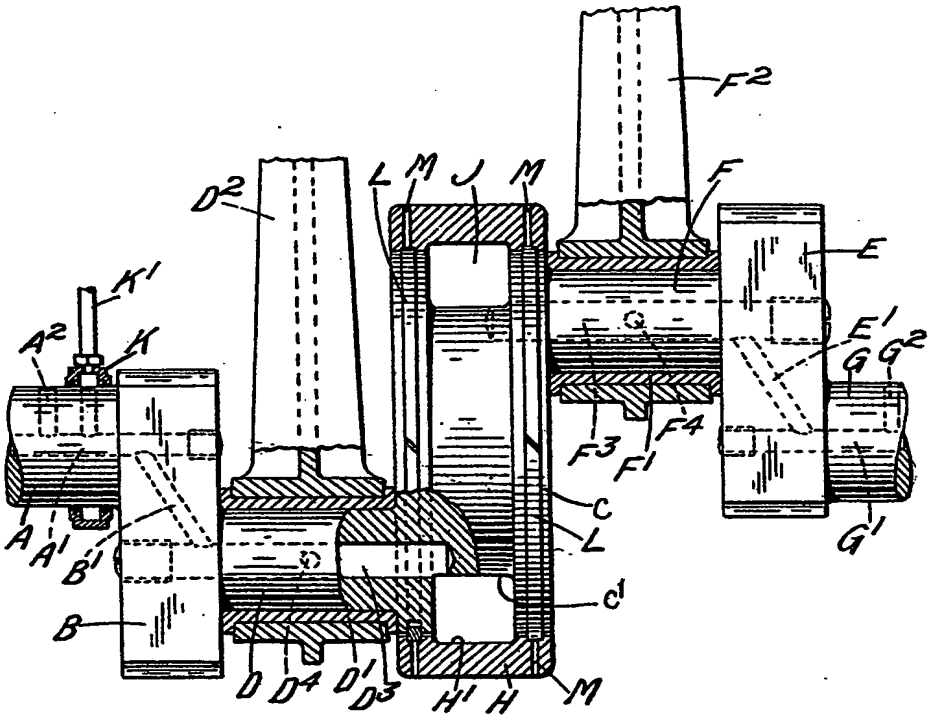

[This Drawing is a reproduction of the Original on a reduced scale.]

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